

**M1.(a)** (i) any **two** from:

- (dead) animal buried in sediment  
*allow imprint in mud*
- hard parts / bones do not decay **or** soft parts do decay  
*allow (one of) the conditions for decay is missing – accept example, eg oxygen / water / correct temperature / bacteria*
- mineralisation (of hard parts / bones)  
*allow replacement by other materials*

2

(ii) any **two** from:

- conditions not right for fossilisation  
*ignore references to soft-bodied*
- geological activity has destroyed fossils / has destroyed evidence  
*allow a named / described example – eg vulcanism / earth movements / erosion*
- fossils not yet found  
*allow description of why not yet found*

2

(b) any **four** from:

- separation / isolation (of different populations)
- different environmental conditions (between locations)
- mutation(s) occur **or** genetic variation (within each population)
- better adapted survive **or** natural selection occurs  
*allow 'survival of the fittest'*  
*ignore animals adapt to their environment*  
*ignore reference to stronger survive*
- favourable alleles passed on (in each population)  
*allow genes for alleles*
- eventually different populations unable to breed successfully with each other  
*allow unable to produce fertile offspring*

4

[8]

**M2.(a)** (i) 3.15 : 1

*accept 3.147:1 or 3.1 : 1 or 3 : 1*  
*do not accept 3.14 : 1*  
*Ignore 705:224*

1

(ii) any **two** from:

- fertilisation is random **or** ref. to chance combinations (of alleles / genes / chromosomes)
- more likely to get theoretical ratios **or** see (correct) pattern **or** get valid results if large number  
*allow ref. to more representative / reliable*  
*do not allow more accurate or precise*  
*ignore fair / repeatable*
- anomalies have limited effect / anomalies can be identified  
*accept example of an anomaly*

2

(b) (i) in sequence:

Homozygous  
Homozygous  
Heterozygous

*All 3 correct = 2 marks*  
*2 correct = 1 mark*  
*1 or 0 correct = 0 marks*

2

(ii) genetic diagram including:

Parental genotypes: **Nn** and **Nn**

*allow other characters / symbols only if clearly defined*

1

**or**

Gametes: **N** and **n** + **N** and **n** derivation of offspring genotypes:

**NN Nn Nn nn**

*allow genotypes correctly derived from candidate's P gametes*

1

identification: **NN** and **Nn** as purple **and nn** as white  
*allow correct identification of candidate's offspring genotypes  
but only if some F<sub>2</sub> are purple and some are white*

1

(c) any **two** from:

- did not know about chromosomes / genes / DNA  
**or** did not know chromosomes occurred in pairs  
*ignore genetics*
- had pre-conceived theories  
*eg blending of inherited characters  
ignore religious ideas unless qualified*
- Mendel's (mathematical) approach was novel concept  
*allow his work was not understood or no other scientist had  
similar ideas*
- Mendel was not part of academic establishment  
*allow he was not considered to be a scientist / not well  
known / he was only a monk*
- work published in obscure journal / work lost for many years
- peas gave unusual results of other species  
*allow he only worked on pea plants*
- Mendel's results were not corroborated until later / 1900

2

[10]

**M3.(a)** (i) variation (in population) / mutation

1

longer nosed individuals get more food / leaves  
*allow longer nosed individuals more likely to survive*

1

(these) survivors breed (more)

1

pass on genes / alleles / DNA (for long nose)  
*allow pass on mutation*

1

- (ii) Phiomia / ancestor stretched its nose (during its lifetime) to reach food / leaves

1

passed on (stretched nose) to offspring  
*allow offspring inherit (stretched nose)*  
*do not allow ref to genes*

1

- (b) (i) insufficient evidence / no proof  
*ignore other theories, eg religion*  
*do not allow no evidence*

1

mechanism of inheritance not known  
*allow genes / DNA not discovered*

1

- (ii) God made all living things / them  
*allow creationism*  
*ignore religion*

1

[9]

- M4.(a)** lack of fossils / fossils destroyed  
*allow lack of evidence*

1

(due to soft parts) decaying / geological activity  
*allow an example – eg vulcanism or earth movements or erosion*  
*allow converse points re skeletons, shells, hard parts*

- 1
- (b) (i) **A** and **B** did not mate successfully  
*'A and B did not mate' insufficient*  
*allow did not produce fertile offspring* 1
- (ii) any **two** from:
- may not be mating season
  - **A** and **B** may not find each other attractive
  - this is just a one-off attempt / an anomaly / need repeats
  - may be juvenile / immature
  - may be the same sex
- allow other sensible suggestion eg were put in unfavourable environment or one / both could be infertile* 2
- (c) 1. (two ancestral populations) separated (by geographical barrier / by land) / were isolated 1
2. genetic variation (in each population) **or** different / new alleles **or** mutations occur 1
3. different environment / conditions  
*allow abiotic or biotic example* 1
4. natural selection occurs **or** some phenotypes survived **or** some genotypes survived 1
5. (favourable) alleles / genes / mutations passed on (in each population) 1
6. eventually two types cannot interbreed successfully  
*allow eventually cannot produce fertile offspring* 1

[11]

**M5.(a)** variation (between organisms within species)

*allow described example*  
*allow mutation – but **not** if caused by change in conditions*

1

those most suited / fittest survive

1

genes / alleles passed on (to offspring / next generation)  
*allow mutation passed on*

1

(b) (i) any **two** from:

*allow converse*

- increase in latitude reduces number of (living) species  
*ignore references to severity of conditions*
- increase in latitude reduces time for evolution (of new species)
- the less the time to evolve the fewer the number of (living) species

2

(ii) any **two** from:

*do **not** accept intention or need to evolve*

- (increase in latitude reduces number of (living) species because) less food / habitats / more competition at high latitude  
*allow only extremophiles / well-adapted species can survive*
- (increase in latitude reduces time for evolution (of new species) because) severe conditions act more quickly / to a greater extent on the weakest
- (the less the time to evolve the fewer the number of (living) species because) species that evolve slowly don't survive

2

[7]

**M6.(a)** organisms that can breed together

*accept converse points re. 2 different species*

1

successfully

*accept produces fertile offspring*

1

(b) any **two** from:  
(live at)

- different pH of soil
- different height above sea level
- different flowering times

2

**AND**

genetic variation / mutation / different alleles (produced in isolated populations)

1

natural selection acts differently on the two populations

or different characteristics in the two populations survive

or different alleles passed on in the two groups

1

eventually resulting in interbreeding no longer possible

1

[7]

**M7.(a)** wing pattern similar to *Amauris*

*allow looks similar to Amauris*

1

birds assume it will have an unpleasant taste

1

- (b) mutation / variation produced wing pattern similar to *Amauris*  
*do not accept breeds with Amauris*  
*do not accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]